Preparedness Technology and Tools:
Decrypting Risk, Resilience, and Social Vulnerability Data

PrepTech Talks

November 17, 2020

National Alliance for Public Safety GIS (NAPSG) Foundation

napsgfoundation.org | @napsgfoundation

Today's Objectives

Which one do I use? Which one is right for my project?

Hosts and Panelists

01

Dr. Shane Hubbard
Space Science and Engineering Center
Cooperative Institute for Meteorological Satellite Studies
University of Wisconsin - Madison

02

Danielle Sharpe, MSc
Geospatial Epidemiologist
Coordinator of the CDC Social Vulnerability Index
Contractor at Perspecta

03

Benjamin C. Rance
Management & Program Analyst- Technical Assistance Branch
National Integration Center | National Preparedness Directorate

Agenda

- 1:00 – 1:05pm **Welcome and Introductions**
- 1:05 – 1:10pm **URISA Community Resilience Committee Social Indices Focus Group** – Dr. Shane Hubbard, University of Wisconsin / URISA CRC Chair
- 1:10 – 1:30pm **CDC Social Vulnerability Index (SVI)** – Danielle Sharpe, MSc Centers for Disease Control and Prevention (Contractor at Perspecta)
- 1:30 – 1:50pm **FEMA's Community Resilience Indicator Analysis (CRIA) / Resilience Analysis and Planning Tool (RAPT)** – Benjamin C. Rance, FEMA
- 1:50 – 1:57pm **Demonstration** Guidance on Risk, Resilience, and Vulnerability Indices
- 1:57 – 2:00pm **Closing**

About NAPSG Foundation

Our Vision

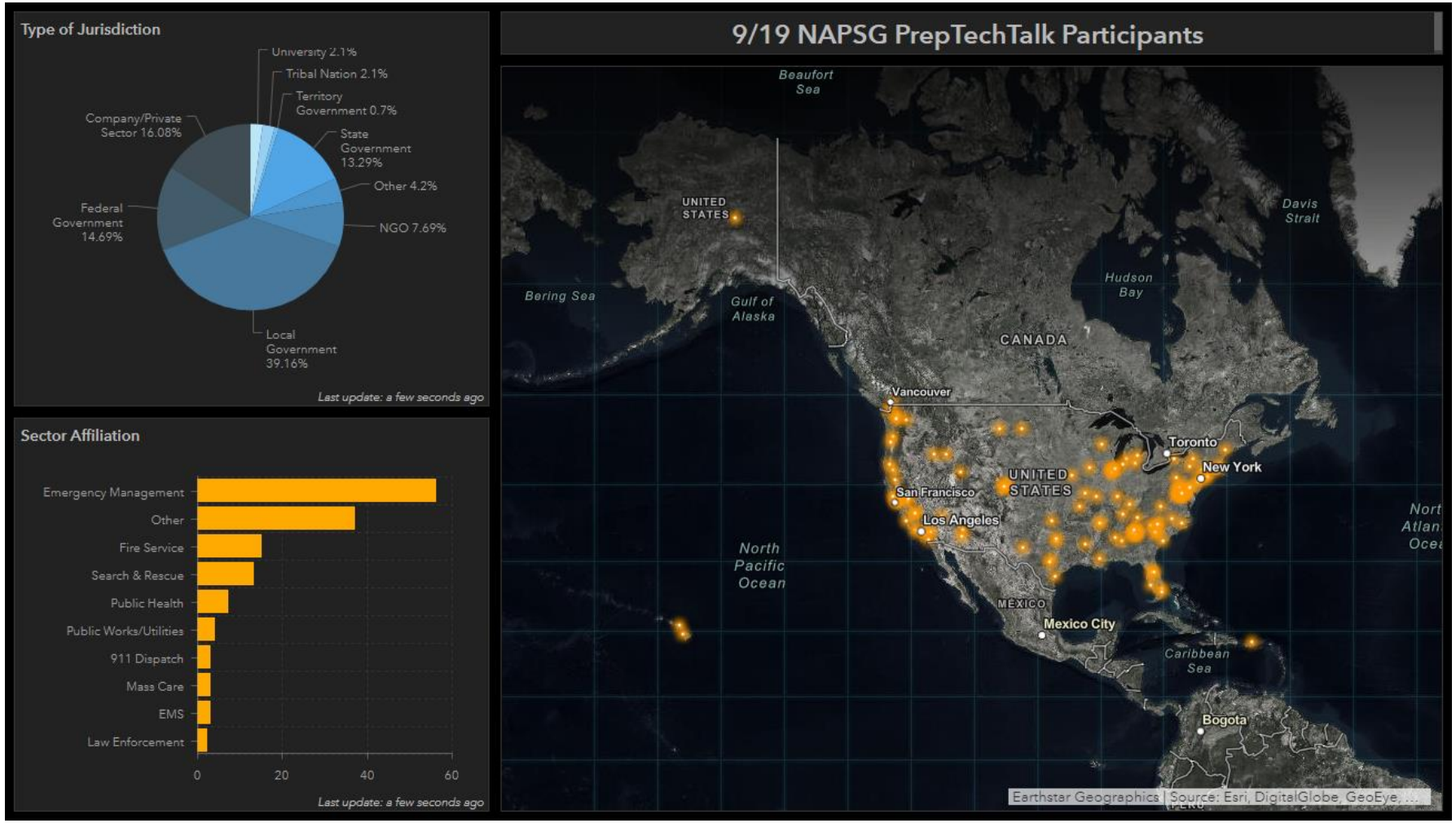
A Nation of emergency responders and leaders equipped with the knowledge and skills in applying technology and data to change the outcome for survivors.

- 501(c)(3) Non-profit organization established in 2005
- +20,000 member network: Public Safety leaders, first responders, and GIS practitioners
- Board of Directors comprised of public safety & emergency management industry leaders

NAPSG Foundation

Local Focus – National Reach

- 20,000+ member network
- 12 primary national & international associations
- All disciplines
- All levels of government
- Private sector



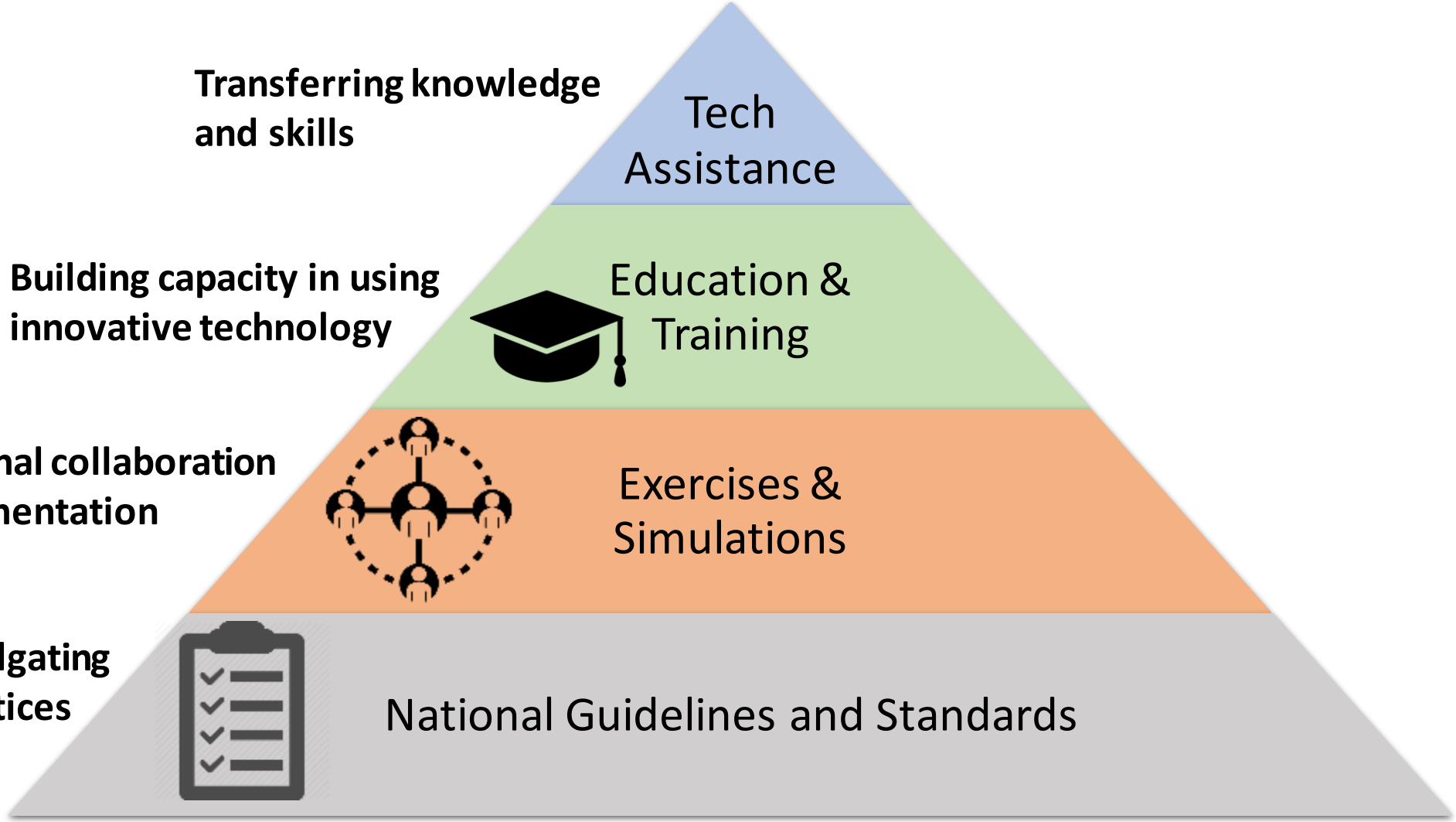
Virtual Training participants with contact details redacted.

From Preparedness through Response and into Recovery

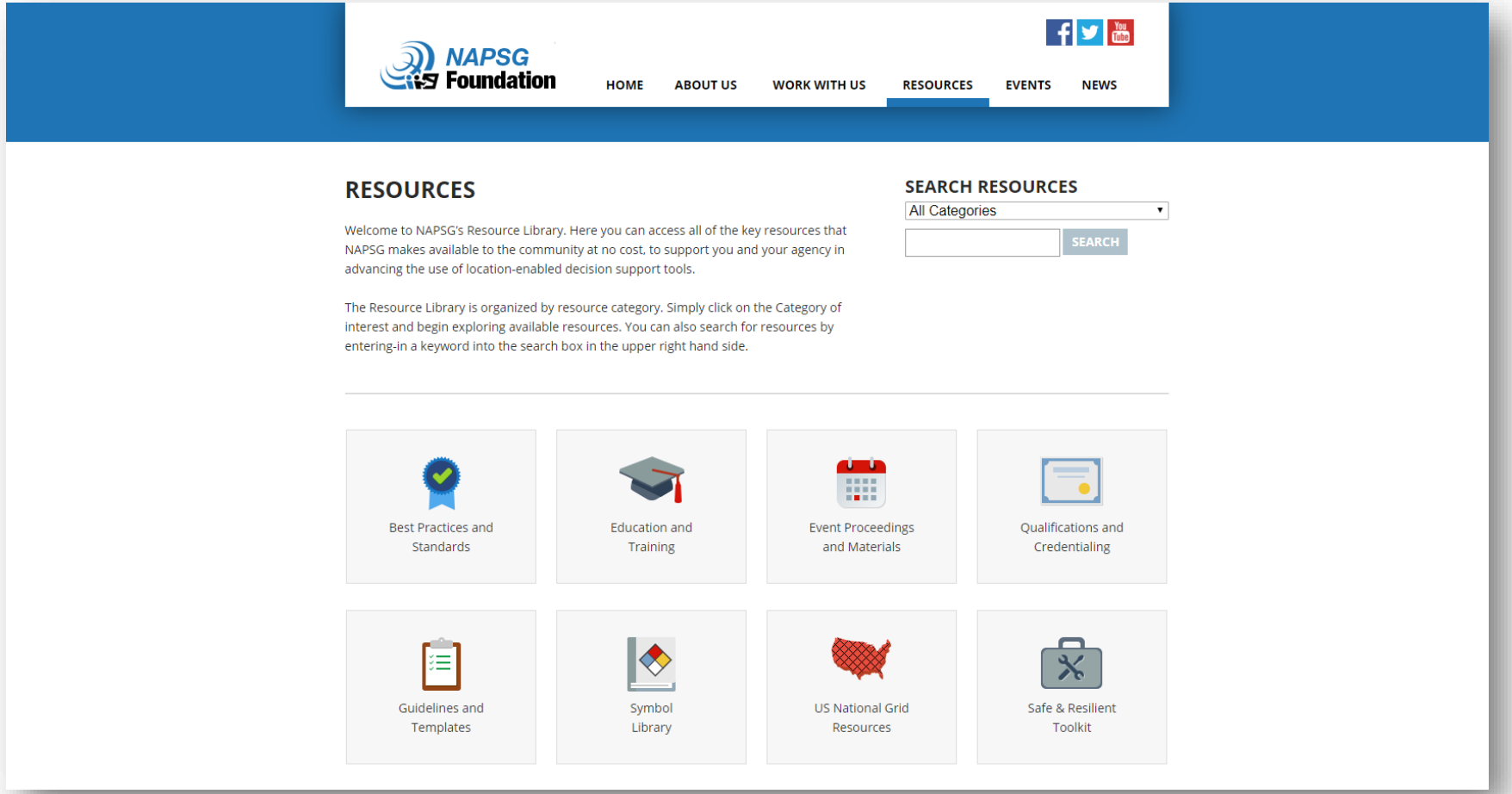
First Responders, Operators, and Decision Makers have access to and know how to use the **right <u>actionable information</u> at the right time**

NAPSG Foundation

How Do We Do It

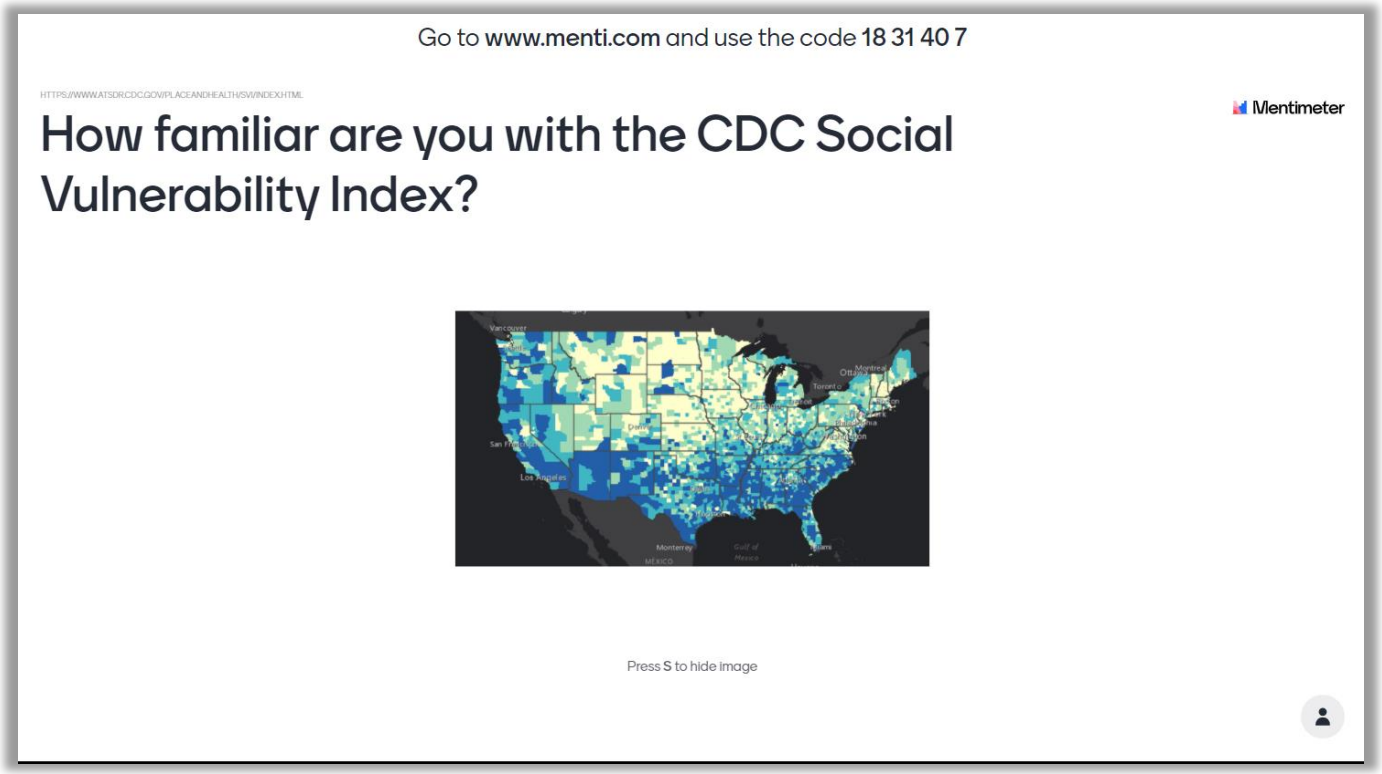


Resource Library



https://www.napsgfoundation.org/all-resources/

Menti Results



Community Resilience Committee

Goals, Objectives, and Accomplishments

Shane Hubbard (incoming chair, Sept 2020)

Goals and Objectives

- Provide information and materials, especially best practices and recommendations, to communities as it relates to resilience
  - Workshops, webinars, white papers
- Establish URISA as a leader in the discussion and producer of knowledge of geospatial data, technologies, and policies for community resilience

https://www.urisa.org/communityresilience

Accomplishments

- Participation on the Pandemic Task Force
  - Guidance on how GIS can and should be used to support a pandemic event
- Dr. Bandana Kar published, “Redefining Resilience in the Face of a Global Health Crisis” in the GIS Professional
- The CRT published a document titled ‘Responsibly Supporting the COVID-19 Pandemic Response’ to the URISA COVID-19 Resources page on April 3, 2020
- Supported a Public Health Track for GIS Pro 2020
- Developed a Community Resilience Story Maps

RESPOND TO THE QUESTIONNAIRE!

Data-driven decision support tools and technology have been essential at all levels in our nation’s response to COVID-19. From case monitoring to personal protective equipment (PPE) management, technology and data have supported response operations in local, state, and federal agencies nationwide. However, the nationwide demand for location-based data analytics and technology has highlighted barriers in data sharing, technology and policy gaps, and other trouble spots in our pandemic preparedness and response capabilities.

As we continue to respond to COVID-19 and prepare for future pandemics, capturing lessons learned and codifying improvement areas are vital in our effort to take corrective actions that increase preparedness and improve response operations. **This is only possible with your participation.** By completing this questionnaire, **your voice and experiences are heard** and accounted for as part of the COVID-19 after-action review (AAR) process.

NAPSG Foundation
URISA Fostering Excellence in GIS
NSGIC National States Geographic Information Council

on the use of data-driven decision support tools and
community in responding to COVID-19. The informa
prepare for and respond to future pandemics.

Redefining Resilience in the Face of a Global Health Crisis

Bandana Kar, Ph.D.

Oak Ridge National Laboratory

In the face of the high death tolls and major economic threats associated with the current COVID-19 pandemic, this global event represents a crucial time to reassess and possibly redefine resilience.

Resilience is not a new term or specific to one discipline. The United Nation defines resilience as *the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions*. As the UN set this definition as the central component of its disaster reduction initiative, resilience has been widely adapted at various scales – from local to global – to assess and activate risk reduction strategies. However, in addition to providing scant description of each concept identified, this UN definition gives minimal instruction on what aspects of a community or society should recover to make it resilient. Essentially, resilience has become a vague term with ambiguous meaning, subject to interpretation and implementation.

Due to the spatiotemporal nature of resilience, the URISA Community Resilience Task Force defines resilience as “the ability to effectively incorporate geospatial technologies and data to reduce the impacts of natural disasters and proposes a holistic approach that includes, but is not limited to, local knowledge about risks, vulnerabilities and impacts; social networks; transportation and utility infrastructures; public health risks and services; governance procedures for addressing a crisis; economic investments; and preparedness.” This definition of resilience accounts for the following integral dimensions required for a resilient community: social, economic, ecological, health (physical and psychological), infrastructure and political.

As the evolving impacts of the COVID-19 pandemic expose the vulnerability of the UN’s current resilience definition, the URISA task force definition accounts for the health components of the crisis that have impacts on the economic resilience of our communities. Considering this new definition, we researchers and professionals need to identify best practices for assessing current resilience and preparing for future resilience of our society by taking into consideration the foundational aspects of Geographic Information Science, such as scaling and reproducibility in the context of geospatial datasets and technologies, which are crucial to assessing resilience and implementing resilience initiatives.

Understanding Scale

The global pandemic requires every country to implement policies that will protect its borders, populace and economy. Thus far, depending on the severity and timing of the outbreak, each country has chosen a unique combination of strategies. For example, in the United States federal government took a more hands-off approach by allowing states and densely populated municipal areas to adopt their own rules and standards for quarantining and sheltering-in-place. Evidently, though the crisis has a global footprint, the containment of its health impacts and spreading requires implementation of policies at a local scale. Contrary to this approach, economic impacts of this pandemic have been widespread and require national-scale policy implementation.

Unlike policies implemented to prevent contagion and revive the economy, analytics and models needed to forecast disease spreading based on mobility, network connectivity, resource availability and allocation require granular implementation. For instance, spatiotemporal models used to forecast disease hotspots cannot be implemented at a county scale, because the population density centroid of a county does not appropriately show that every individual is susceptible to infection. Thus, such an analysis needs to be modeled at an individual level. Likewise, resource allocation models need to be deployed at the local community level (i.e., the census block level) to provide a clear picture of resource supply and demand at the local level to account for the dynamic nature of disease spread and resource needs on a daily basis.

Another aspect of this scale discussion should focus on the definition of space versus place. The virtual space connected through 5G networks has enabled the socio-political systems to stay connected during this pandemic. The lack of connectivity and mobility in physical space has diminished economic transactions, thereby reducing the economic resilience of local communities, countries, continents and the entire globe. As opposed to space, place refers to a location that has a meaning for a specific community. Thus, researchers, decision makers and other stakeholders need to acknowledge that while policies pertaining to resource allocation and supply-demand should be deployed at a place level, economic revival policies need to be deployed at physical and virtual spaces and regional level.

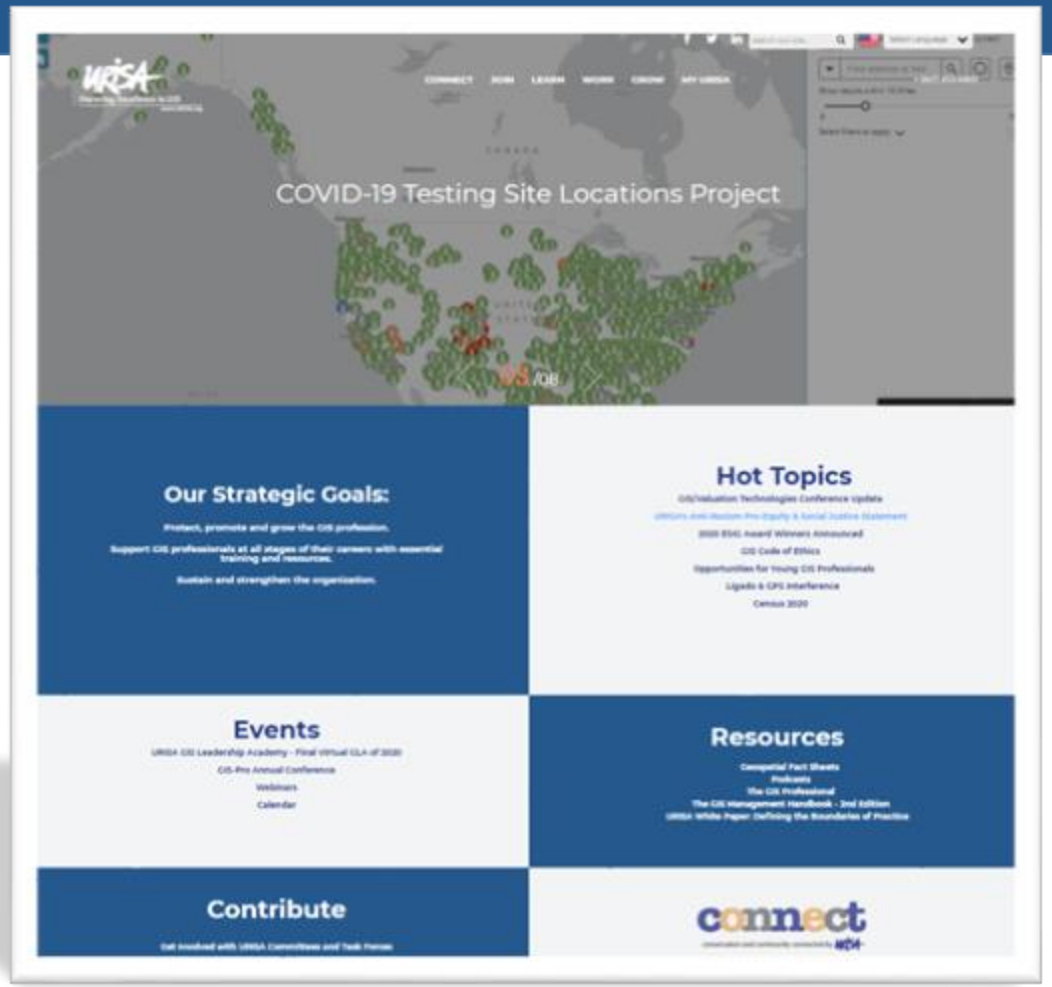
Ensuring Reproducibility and Replicability

In recent years, the terms Reproducibility and replicability have been at the forefront of scientific research. According to the National Academy of Sciences, Reproducibility means *obtaining consistent computational results using the same input data, computational steps, methods, code, and conditions of analysis*. Replicability means *obtaining consistent results across studies aimed at answering the same scientific question, each of which has obtained its own data*. The following

5

Future Directions

- Continue to produce additional articles highlighting community resilience best practices
- Quarterly Webinars on current topics
- Further collaborations nationwide
- Supporting two new working groups
  - Climate Change and Community Equity
  - Community Resilience and Sectoral Dependencies



https://www.urisa.org/

Centers for Disease Control and Prevention Social Vulnerability Index (CDC SVI)

CDC SVI SOCIAL VULNERABILITY INDEX

Danielle Sharpe, MSc
CDC SVI Coordinator

November 17, 2020

National Center for Environmental Health
Agency for Toxic Substances and Disease Registry

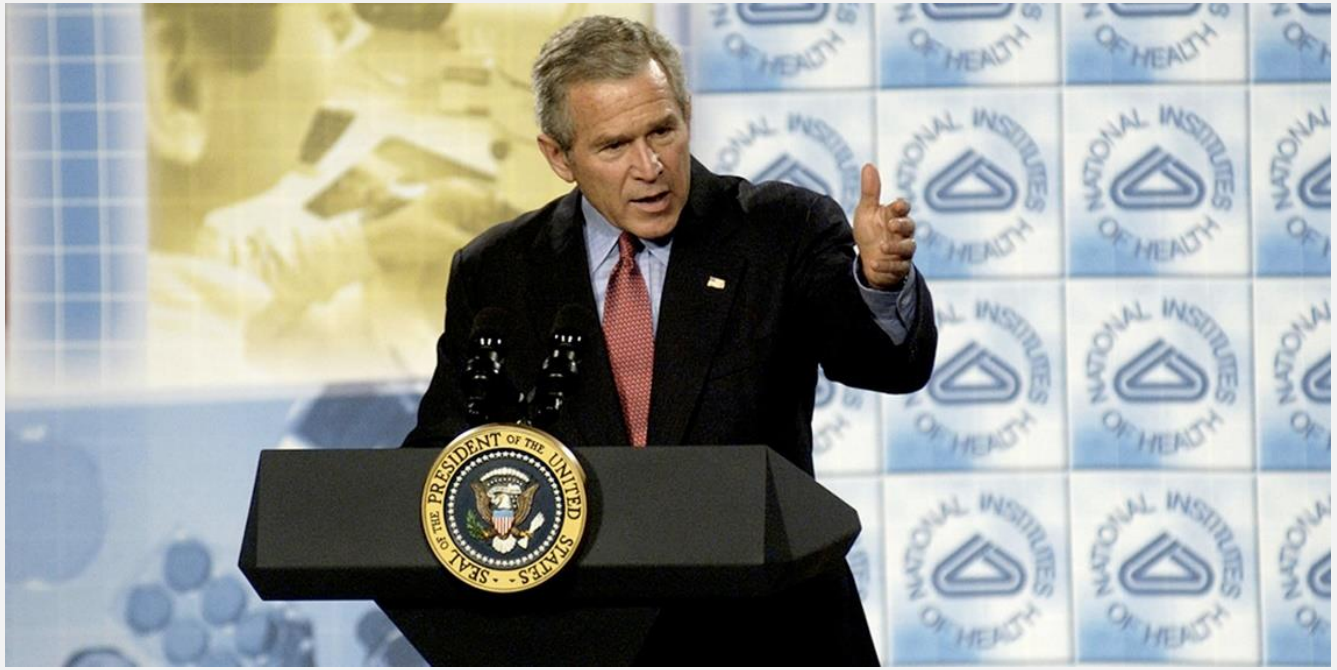
Today’s Agenda

- Overview of the CDC Social Vulnerability Index
- Demonstration of the CDC Social Vulnerability Index
- Wrap-up and Questions

CDC SVI: AN OVERVIEW

Pandemic and All-Hazards Preparedness Act of 2006

- The Pandemic and All-Hazards Preparedness Act of 2006 cited public health and medical preparedness and response capabilities for emergencies as a critical need for the nation, for which CDC decided to build agency capacity for addressing social vulnerability to disasters and public health emergencies.

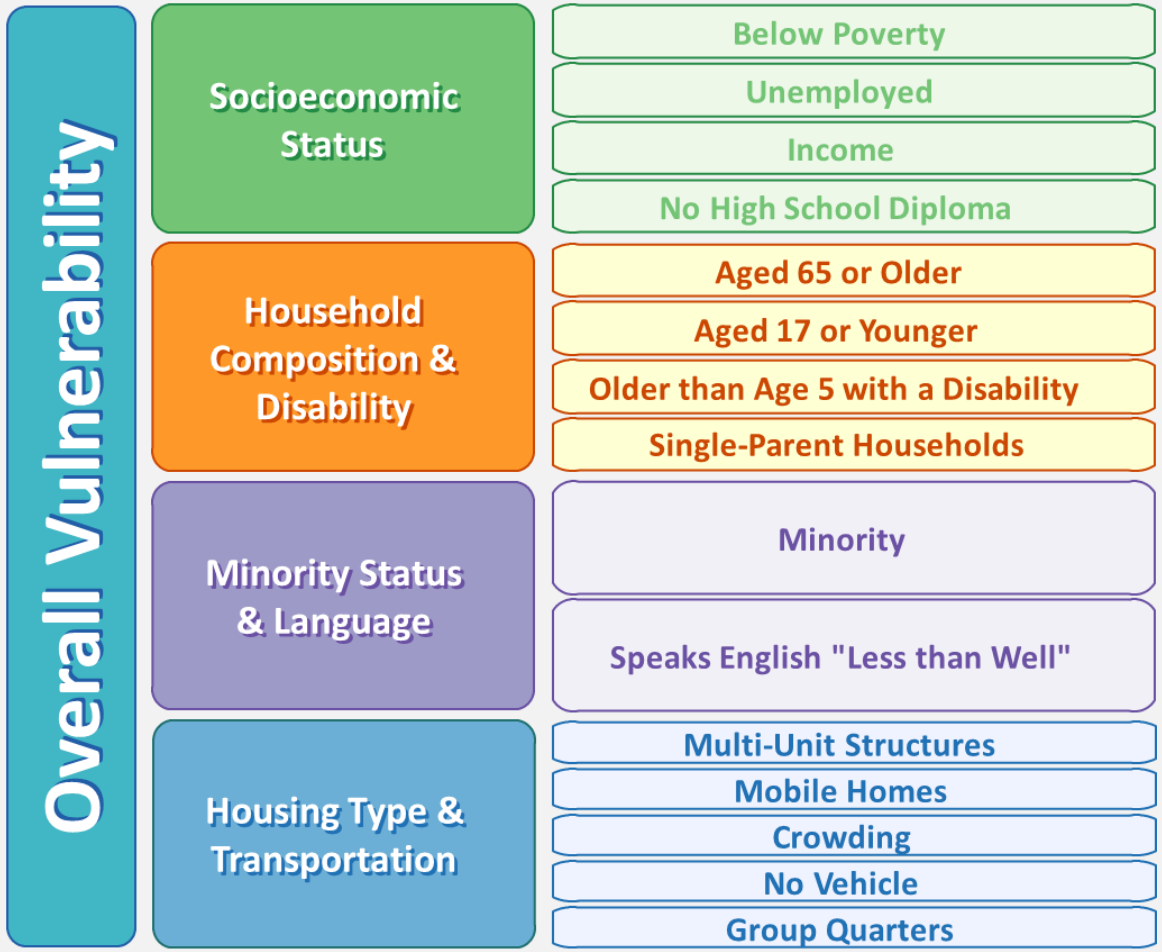


President George W. Bush signed the Pandemic and All-Hazards Preparedness Act into law on December 19, 2006.

The Purpose of the CDC Social Vulnerability Index

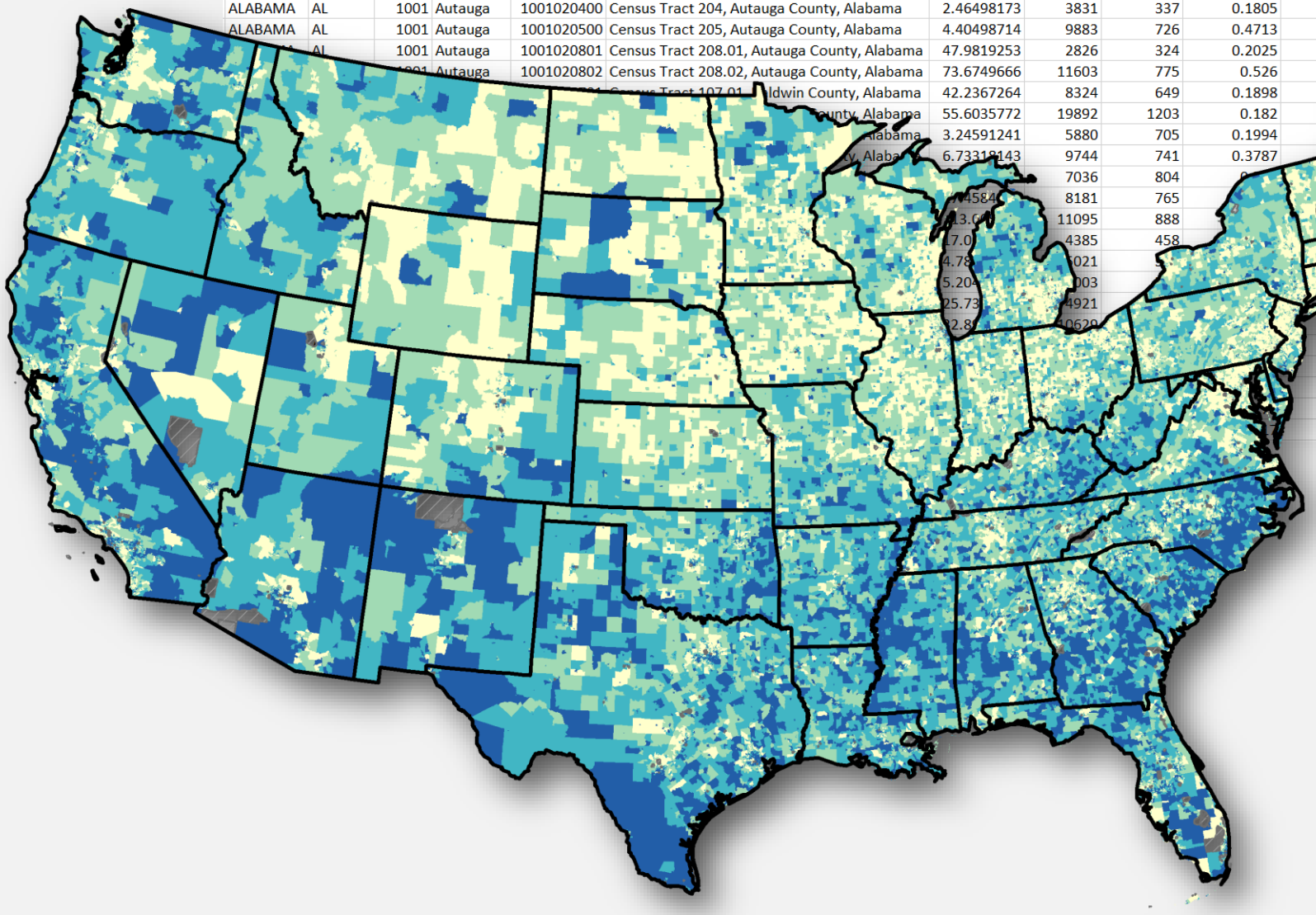
- Social vulnerability refers to the demographic and socioeconomic factors that adversely affect communities that encounter hazards.
- The CDC SVI tool was developed as a database and mapping tool to assist disaster management and public health officials with identifying locations of their most socially vulnerable populations over the disaster cycle.

CDC SVI Data and Methodology

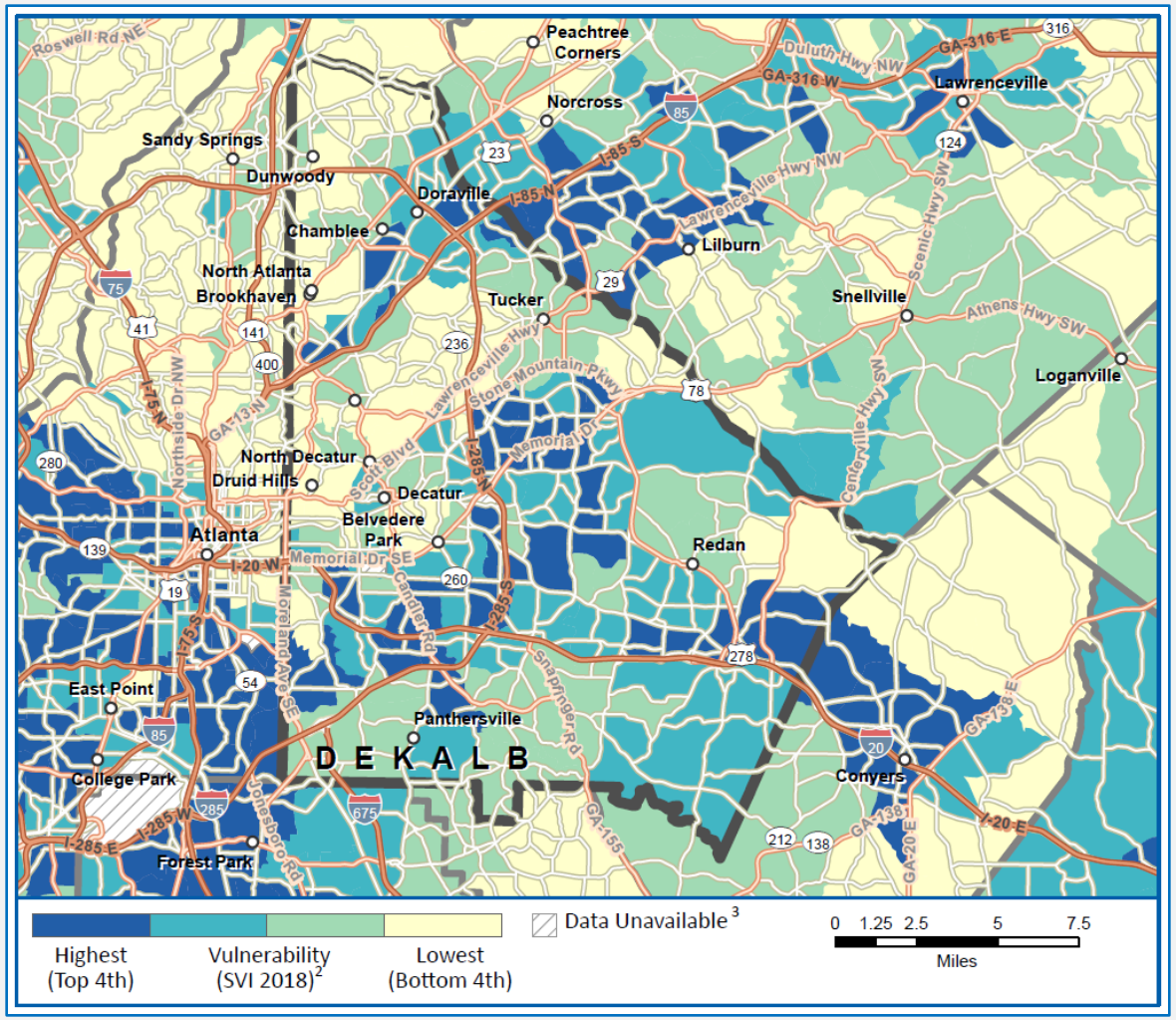


- Composed of Census Bureau data on 15 variables grouped into four themes and a measure of overall SVI
- Constructed using percentile ranks to score areas from 0-1 on vulnerability
- Developed for the U.S. and each state at census tract and county levels
- Puerto Rico & tribal tracts
- Available for 2000, 2010, 2014, 2016, and 2018

STATE	ST_ABBR	STCNTY	COUNTY	FIPS	LOCATION	AREA_SQMI	E_TOTPOP	M_TOTPOP	RPL_THEMES	F_TOTAL	E_UNINSUR	M_UNINSUR	EP_UNINSUR	MP_UNINSUR	E_DAYPOP
ALABAMA	AL	1001	Autauga	1001020100	Census Tract 201, Autauga County, Alabama	3.79067723	1923	253	0.2533	0	178	79	9.3	4.1	1018
ALABAMA	AL	1001	Autauga	1001020300	Census Tract 203, Autauga County, Alabama	2.065365	3476	433	0.64	1	119	81	3.4	2.2	1836
ALABAMA	AL	1001	Autauga	1001020400	Census Tract 204, Autauga County, Alabama	2.46498173	3831	337	0.1805	0	108	100	2.8	2.6	1951
ALABAMA	AL	1001	Autauga	1001020500	Census Tract 205, Autauga County, Alabama	4.40498714	9883	726	0.4713	0	398	223	4.2	2.4	8342
[illegible]	AL	1001	Autauga	1001020801	Census Tract 208.01, Autauga County, Alabama	47.9819253	2826	324	0.2025	0	144	84	5.1	2.9	1331
[illegible]	[illegible]	[illegible]	Autauga	1001020802	Census Tract 208.02, Autauga County, Alabama	73.6749666	11603	775	0.526	0	662	274	5.8	2.4	5851
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] ldwin County, Alabama	42.2367264	8324	649	0.1898	0	567	284	6.9	3.4	6929
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] unty, Alabama	55.6035772	19892	1203	0.182	0	850	733	9.3	3.5	16160
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] abama	3.24591241	5880	705	0.1994	0	[illegible]	196	7.1	3.3	3839
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] y, Alaba	6.73318143	9744	741	0.3787	[illegible]	522	234	5.4	2.4	10886
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7036	804	[illegible]	[illegible]	324	201	4.8	3.1	10264
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8181	765	[illegible]	[illegible]	1452	574	17.8	6.8	7949
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11095	888	[illegible]	[illegible]	401	182	3.6	1.7	5898
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4385	458	[illegible]	[illegible]	251	117	5.7	2.7	3821
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	323	265	6.5	5.1	6896
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	454	237	7.7	4	6891
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	257	147	5.2	2.9	3647
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	1155	550	10.9	5.2	8198
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	47	38	7.6	5.5	1014
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	640	252	11.2	4	10746
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	2337	738	18.7	5.5	14648
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	113	80	4.8	3.3	1977
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	509	181	12.7	4.2	4581

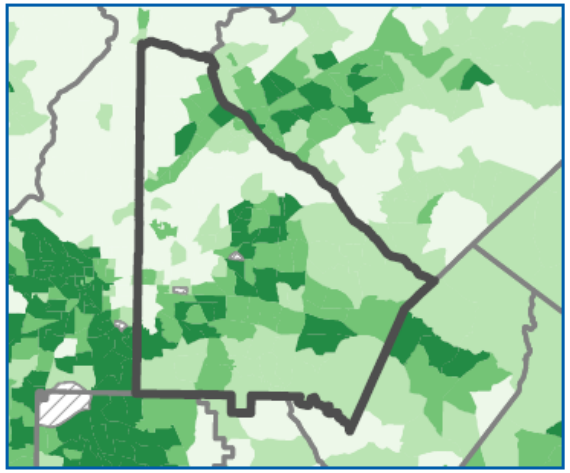


Prepared County Maps



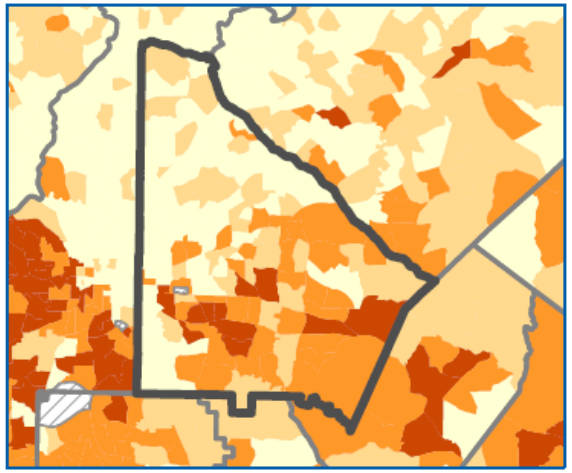
CDC SVI Themes

Socioeconomic Status[5]



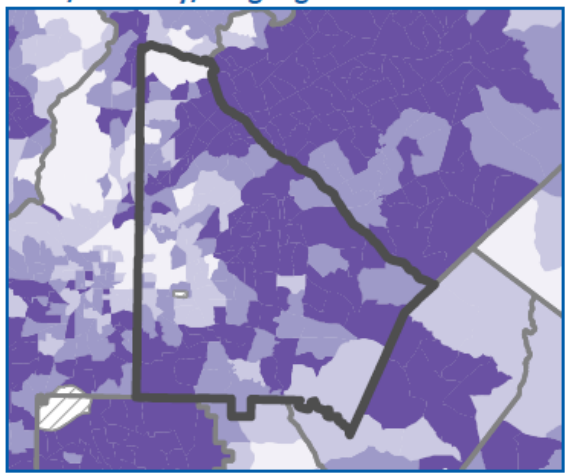
Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Household Composition/Disability[6]



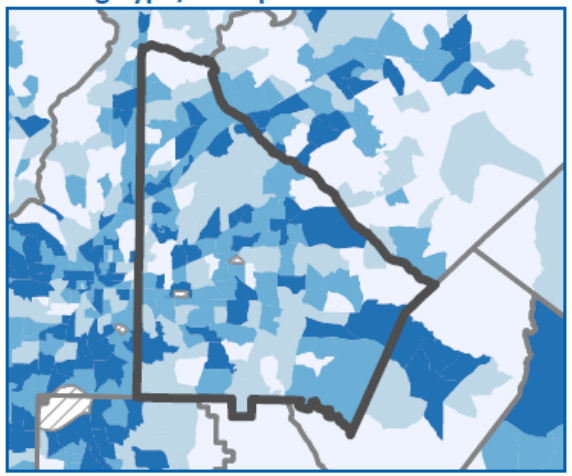
Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Race/Ethnicity/Language[7]



Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

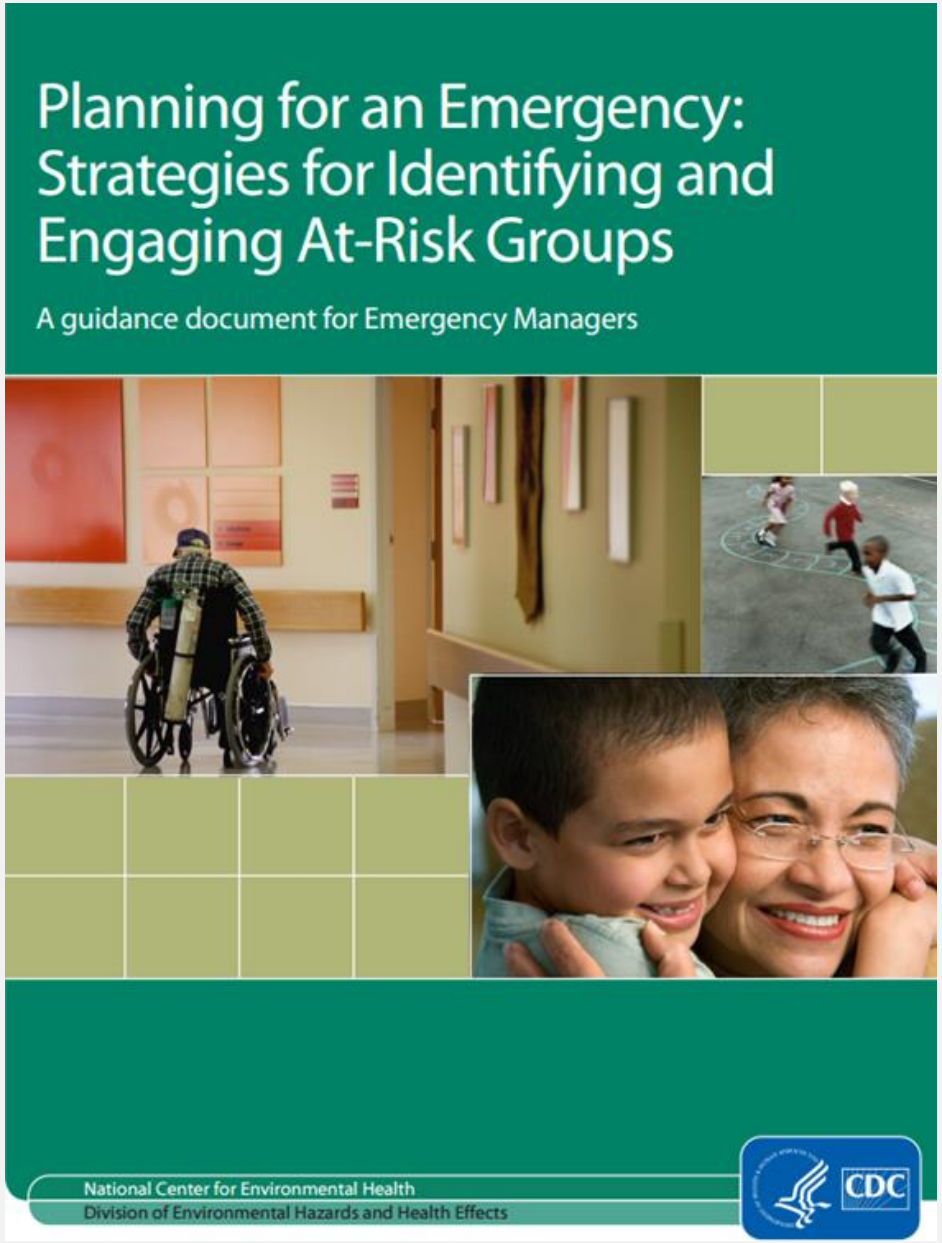
Housing Type/Transportation[8]



Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

CDC SVI Utility and Use Cases

- The CDC SVI tool is used by several U.S. state and local governments as well as several private sector organizations. For example, it has been used to:
  - Assess social vulnerability and physical hazards (e.g., sea level rise, flooding, tornadoes, volcanic risk, house fires), hazard awareness, migrant and refugee populations, and health status
  - Map fire outbreaks and vulnerability metrics to target aid during emergencies (Lue & Wilson, 2017)
  - Plan hazard mitigation (Horney et al., 2017; Horney, Simon, Grabich, & Berke, 2015)
  - Assess social vulnerability and pathogenic disease outbreaks (Karaye & Horney, 2020; Khazanchi et al., 2020)



CDC SVI: A DEMONSTRATION

Resilience Analysis and Planning Tool (RAPT)

National Integration Center Technical Assistance| November 2020

FEMA

Resilience Analysis and Planning Tool (RAPT)

- Publicly available GIS tool to inform **strategies for preparedness, response, and recovery**.
- Allows **combined analysis** of Population / Community data, Infrastructure data, and Hazard data. All data is open source.
- **20 Commonly-Used Community Resilience Indicators** from peer-reviewed published methodologies.
- Infrastructure data from Homeland Infrastructure Foundation-Level Data (HIFLD) includes **location and characteristics**
- Hazard layers: **historic data, risk data, and real-time severe weather forecasts**
- **Analysis Tools**: Incident Analysis Tool, Select Population Summary, Query
- **Add Data**: Temporarily upload additional GIS layers

Community Resilience Indicator Analysis:

Methodology to Identify Commonly Used Indicators of Community Resilience

1. Conducted Literature Review of Meta-Analyses
2. Cataloged 73 Distinct Methodologies/ Indices
3. Created & Applied Inclusion Criteria
   - County-level
   - Generalized hazard risk
   - Pre-disaster focus
   - Quantitative
   - Public methodology
   - Public data
4. Identified 20 Commonly Used Indicators
5. Binned Indicator Data for Visual Display

- Australian National Disaster Resilience Index (ANDRI)
- Baseline Resilience Indicators for Communities (BRIC)
- Community Disaster Resilience Index (CDRI)
- Community Resilience Index (CRI2)
- Disaster Resilience of Place (DROP)
- Resilient Capacity Index (RCI)
- Social Vulnerability Index (SVI)
- The Composite Resilience Index (TCRI)

RAPT Data Sets

Population-Focused Indicators	Community-Focused Indicators	Infrastructure Data	Hazard Data
CRIA Commonly Used Indicators	CRIA Commonly Used Indicators		Historic / Risk
% Population without Health Insurance[a,b]	Connection to Civic/ Social Organizations	Nursing Homes	Flood Hazard Zones
% Population Unemployed[a,b]	Hospital Capacity	Hospitals	Tornado Paths
% Population without a High School Education[a,b]	Medical Professional Capacity	Urgent Care Facilities	Tropical Storms
% Population with a Disability[a,b]	Affiliation with a Religion	Public Health Depts.	Seismic Hazards
% Population without Access to a Vehicle[a,b]	Presence of Mobile Homes*	Fire Stations	Wildfire
% Population with Home Ownership[a,b]	Public School Capacity	Emergency Medical Services (EMS) stations	
% Population over 65[a,b]	Population Change	Local Law Enforcement locations	NOAA Layers
% Population Single-Parent Households[a,b]	Hotel/Motel Capacity	911 Service Area Boundaries	Current Watches/ Warnings
% Population with Limited English Proficiency[a,b]	Rental Property Capacity[a,b]	Mobile Home Parks	Hurricane Outlook: Atlantic
Median Household Income[a,b]		Places of Worship	Severe Weather Outlook
Gini Index: Income Inequality[b]		Public Schools	Excessive Rainfall Outlook
		Private Schools	River Flood Outlook
Other Population Indicators		Colleges and Universities	
At-risk electricity-dependent Medicare beneficiaries		Prison Boundaries	
		Transmission Lines	
		Electric Power Plants	
		Solid Waste Landfills	
		Wastewater Treatment Plants	
		Pharmacies (RX Open)	
		Dialysis Centers	
		High Hazard Dams	

RAPT Demonstration

Fema.gov/rapt

FEMA

RAPT Benefits

- User-friendly research tool that helps visualize **the interplay of population characteristics, infrastructure, and hazards**
- Basis for **community resilience profile:**
- **Multi-level analysis**: regional, state, local, tribal.
- Support to emergency managers:
  - Inform capability targets for **THIRA/SPR, exercises, and EOPs**
  - Real-time analysis of **severe weather events**
  - Prioritize **areas for evacuation**
  - Identify at-risk **infrastructure assets**
  - Helps prioritize **recovery strategies**

Questions or Comments?

www.fema.gov/rapt

FEMA-TARequest@fema.dhs.gov

FEMA

Decrypting Risk, Resilience, and Vulnerability Indices

Report out and Demonstration

Background

Challenge

In recent years, there has been an increase of available indices that measure risk, resilience, and vulnerability. Although these indices have provided valuable insights into our communities, they have also prompted some confusion over which index to use, when to use it, and for what purpose.

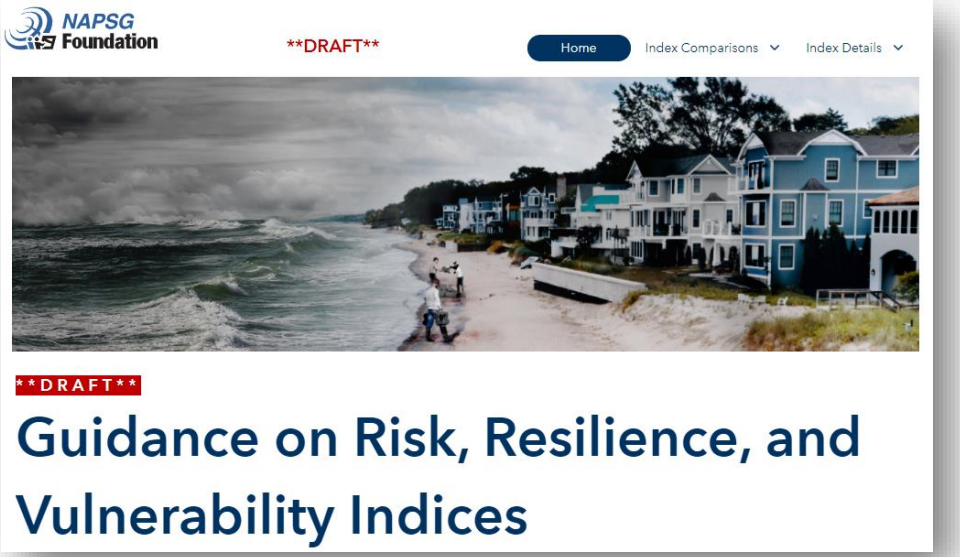
Response

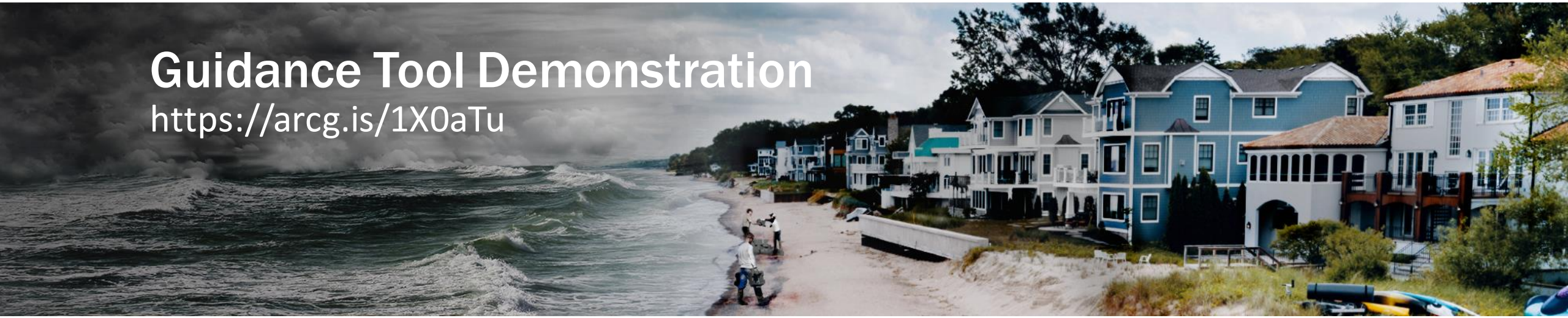
NAPSG Foundation, in partnership with URISA's Community Resilience Task Force, launched a study to understand available and emerging risk, resilience, and vulnerability indices as the basis for developing guidance to help the emergency management community match business needs with specific indices.

The Guidance

The goal of this guidance is to assist the emergency management/public safety community in **understanding the risk, resilience, and vulnerability ind**ices that are available today, the **data and methodologies behind those indices**, and their **relevance for use in preparedness and response**.

To help **users select the appropriate index to answer their specific questions**.





Guidance Tool Demonstration

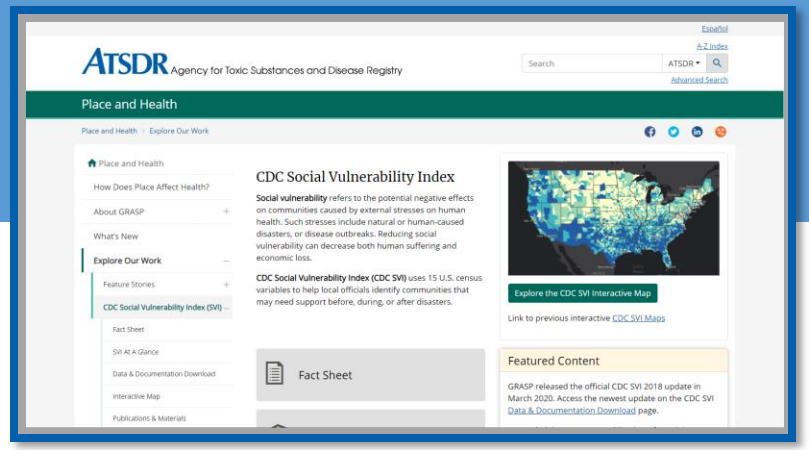
https://arcg.is/1X0aTu

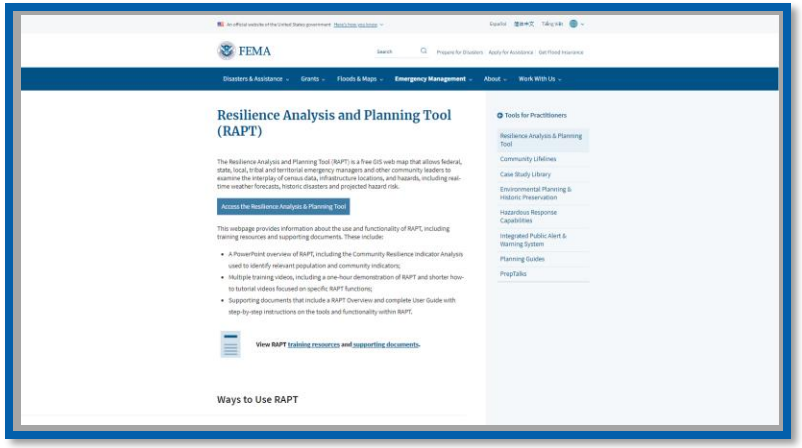
Call to Action

Explore available resources on available indices and tools:

- CDC Social Vulnerability Index
  https://www.atsdr.cdc.gov/placeandhealth/svi/index.html
- Resilience Analysis and Planning Tool (RAPT)
  https://www.fema.gov/emergency-managers/practitioners/resilience-analysis-and-planning-tool
- Review our Guidance and Provide Feedback!
  https://arcg.is/1X0aTu
  - How are you using risk, resilience, vulnerability data and indices?
  - What enhancement would you like to see in the tool?

Share your Feedback: https://arcg.is/1fTzSW



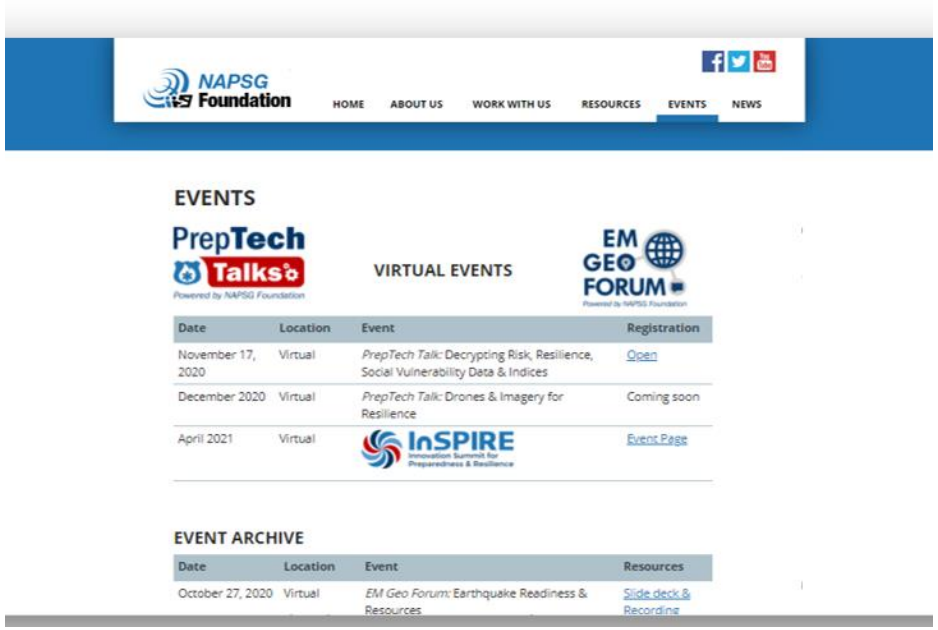


What's Next?

- Next PrepTech Talk:
  - Part 2: Decrypting Risk, Resilience, Social Vulnerability Data & Indices

    (February 2021)

- Events:
  - InSPIRE – Annual flagship event. Virtual! (April 2021)



https://www.napsgfoundation.org/events/

Thank you!

Questions?

CONTACT 1: contact@publicsafetygis.org

CONTACT 2: contact@publicsafetygis.org